

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11)

EP 1 368 826 A2

(43) Date of publication:
10.12.2003 Bulletin 2003/50

(51) Int. Cl.⁷: **H01L 21/321**

(21) Application number: **02717453.1**

(86) International application number:
PCT/US02/04806

(22) Date of filing: **19.02.2002**

(87) International publication number:
WO 02/075804 (26.09.2002 Gazette 2002/39)

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC
NL PT SE TR**

(30) Priority: **14.03.2001 US 275874 P**
24.04.2001 US 286107 P
01.10.2001 US 326263 P
03.01.2002 US 38066

(71) Applicant: **Applied Materials, Inc.**
Santa Clara, California 95054 (US)

(72) Inventors:
, CHEN, Liang-Yuh,
Foster City, CA 94404 (US)
, HSU, Wei-Yung,
Santa Clara, CA 95054 (US)

, DUBOUST, Alain
Sunnyvale, CA 94086 (US)
, MORAD, Ratson
Palo Alto, CA 94306 (US)
, CARL, Daniel, A.
Pleasanton, CA 94566 (US)
, SOMEKH, Sasson
Los Altos Hills, CA 94022 (US)
, MAYDAN, Dan
Los Altos Hills, CA 94022 (US)

(74) Representative:
Bayliss, Geoffrey Cyril et al
BOULT WADE TENNANT,
Verulam Gardens
70 Gray's Inn Road
London WC1X 8BT (GB)

(54) **PLANARIZATION OF SUBSTRATES USING ELECTROCHEMICAL MECHANICAL POLISHING**

(87) This international application for which the EPO is a designated office has not been republished by the EPO according to article 158(1) EPC.

Cette demande internationale pour laquelle l'OEB est office désigné n'a pas été republiée par l'OEB en vertu de l'article 158(1) CBE.

Diese internationale Anmeldung, für die das EPA Bestimmungsamt ist, würde, gemäß Artikel 158(1) EPÜ, vom EPA nicht wieder veröffentlicht.

EP 1 368 826 A2

THIS PAGE BLANK (USPTO)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
26 September 2002 (26.09.2002)

PCT

(10) International Publication Number
WO 02/075804 A3

(51) International Patent Classification⁷: **H01L 21/321**

(21) International Application Number: **PCT/US02/04806**

(22) International Filing Date: 19 February 2002 (19.02.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/275,874	14 March 2001 (14.03.2001)	US
60/286,107	24 April 2001 (24.04.2001)	US
60/326,263	1 October 2001 (01.10.2001)	US
10/038,066	3 January 2002 (03.01.2002)	US

(71) Applicant: **APPLIED MATERIALS, INC.** [US/US];
3050 Bowers Avenue, Santa Clara, CA 95054 (US).

(72) Inventors: **CHEN, Liang-Yuh**; 1400 Melbourne Street,
Foster City, CA 94404 (US). **HSU, Wei-Yung**; 4501

Carlyle Court, Apt. # 1104, Santa Clara, CA 95054 (US).
DUBOUST, Alain; 668 Bryan Avenue, Sunnyvale, CA
94086 (US). **MORAD, Ratson**; 4157 Solana Drive, Palo
Alto, CA 94306 (US). **CARL, Daniel, A.**; 2161 Pomezia
Court, Pleasanton, CA 94566 (US). **SOMEKH, Sasson**;
25625 Moody Road, Los Altos Hills, CA 94022 (US).
MAYDAN, Dan; 12000 Murietta Lane, Los Altos Hills,
CA 94022 (US).

(74) Agent: **PATTERSON, William, B.**; Moser, Patterson &
Sheridan, LLP, Suite 1500, 3040 Post Oak Blvd., Houston,
TX 77056 (US).

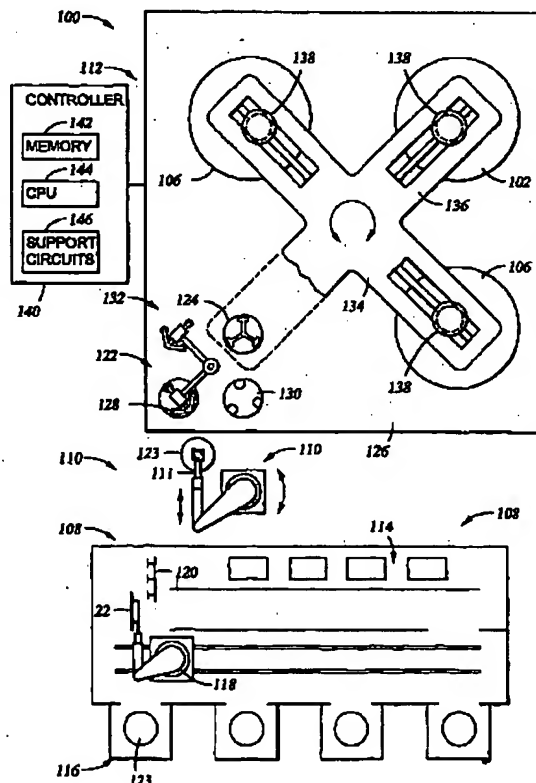
(81) Designated States (*national*): CN, JP, KR, SG.

(84) Designated States (*regional*): European patent (AT, BE,
CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,
NL, PT, SE, TR).

Published:
— with international search report

[Continued on next page]

(54) Title: **PLANARIZATION OF SUBSTRATES USING ELECTROCHEMICAL MECHANICAL POLISHING**



(57) Abstract: A method and apparatus are provided for planarizing a material layer on a substrate. In one aspect, a method is provided for processing a substrate including forming a passivation layer on a substrate surface, polishing the substrate in an electrolyte solution, applying an anodic bias to the substrate surface, and removing material from at least a portion of the substrate surface. In another aspect, an apparatus is provided which includes a partial enclosure, polishing article, a cathode, a power source, a substrate carrier movably disposed above the polishing article, and a computer based controller to position a substrate in an electrolyte solution to form a passivation layer on a substrate surface, to polish the substrate in the electrolyte solution with the polishing article, and to apply an anodic bias to the substrate surface or polishing article to remove material from at least a portion of the substrate surface.

WO 02/075804 A3

WO 02/075804 A3



(88) Date of publication of the international search report:
26 June 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/04806**A. CLASSIFICATION OF SUBJECT MATTER**
IPC 7 H01L21/321

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

INSPEC, EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 807 165 A (HARPER JAMES MCKELL EDWIN ET AL) 15 September 1998 (1998-09-15) column 4, line 55 - line 60	1-3
X	WO 00 26443 A (NUTOOL INC) 11 May 2000 (2000-05-11) the whole document	25, 35
X	SU 1 618 538 A (RREDRIYIATIE R YIA A 1067) 7 January 1991 (1991-01-07) the whole document	25
A	EP 0 846 742 A (CABOT CORP) 10 June 1998 (1998-06-10) the whole document	
	--- -/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

A document member of the same patent family

Date of the actual completion of the international search

26 March 2003

Date of mailing of the international search report

01/04/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Königstein, C

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/04806

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>WO 99 65072 A (SPEEDFAM IPEC CORP) 16 December 1999 (1999-12-16) the whole document</p>	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 02/04806

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5807165	A	15-09-1998	NONE	
WO 0026443	A	11-05-2000	US 6176992 B1 AU 1461700 A CN 1329681 T EP 1129237 A2 JP 2002528649 T WO 0026443 A2 US 2001042690 A1 US 2002153256 A1 US 2003006147 A1 US 6409904 B1	23-01-2001 22-05-2000 02-01-2002 05-09-2001 03-09-2002 11-05-2000 22-11-2001 24-10-2002 09-01-2003 25-06-2002
SU 1618538	A	07-01-1991	SU 1618538 A1	07-01-1991
EP 0846742	A	10-06-1998	US 5954997 A US 6126853 A US 6309560 B1 AU 5373998 A EP 0846742 A2 JP 11021546 A KR 2000057476 A TW 419714 B WO 9826025 A1 US 2002145127 A1 US 2002033382 A1 US 6362106 B1	21-09-1999 03-10-2000 30-10-2001 03-07-1998 10-06-1998 26-01-1999 15-09-2000 21-01-2001 18-06-1998 10-10-2002 21-03-2002 26-03-2002
WO 9965072	A	16-12-1999	US 6121152 A TW 425665 B WO 9965072 A1	19-09-2000 11-03-2001 16-12-1999

THIS PAGE BLANK (USPTO)